CHAPTER 2. ALL-WEATHER TERMINAL AREA OPERATIONS

SECTION 2. GENERAL CONCEPTS FOR ALL-WEATHER TERMINAL AREA APPROACH PROCEDURES

441. GENERAL. This chapter contains a discussion of all-weather terminal area (AWTA) operations, including takeoff, departure, approach, and landing operations. AWTA operations are those operations conducted in the terminal area under instrument flight rules. Terminal area operations conducted under visual flight rules (VFR) in visual weather conditions are not addressed in this chapter. This section discusses general concepts for AWTA approach and landing operations conducted under instrument flight rules (IFR). The basic principle for AWTA approach and landing operations is that operating minimums are permitted to be reduced through improvements in operational capabilities. This principle is valid only if an acceptable escape capability (missed approach) is maintained or if an extremely high probability of safely completing the maneuver exists. All instrument approach procedures (IAP) are constructed to permit safe instrument flight to the missed approach point followed by an instrument missed approach. The safety of conducting an instrument approach to a published minimum and executing the missed approach is not dependent on establishing visual reference with the landing surface. The criteria for constructing an instrument approach are based on the premise that an instrument missed approach will be necessary under certain circumstances. Visual reference with the landing surface, however, becomes a safety factor when the flight descends below the published IFR minimum height or altitude. The visibility or runway visual range (RVR) for a particular runway becomes a safety consideration in both fuel planning and selection of alternate airports.

443. BASIC TYPES OF AWTA APPROACH AND LANDING OPERATIONS. There are two generic classes of approach and landing operations, those conducted under VFR and those conducted under IFR. There are three basic types of IFR approach and landing operations: visual approaches, contact approaches, and instrument approaches.

A. *Visual Approaches.* A visual approach can be authorized by ATC if the aircraft is being operated under IFR in VFR weather conditions (see the Airman's Information Manual). Although a pilot conducting a visual approach is expected to proceed to the destination airport by pilotage or by visual reference to another aircraft, the flight remains under an instrument flight plan. Air traffic control (ATC) retains responsibility for both traffic separation and wake-vortex separation, unless the pilot is following another aircraft and has established visual contact with it. ATC will provide flight-following and traffic information until the aircraft is instructed to contact the control tower. Either ATC or the pilot may initiate a request for a visual approach.

NOTE: Charted visual flight procedures (CVFP), a subset of visual approaches, are also considered to be visual approaches.

B. *Contact Approach.* A contact approach can only be authorized by ATC when requested by the pilot. The flight must be operated clear of clouds and in accordance with an IFR flight plan. The ground visibility at the destination airport must be reported to be at least 1 statute mile otherwise ATC will not authorize a contact approach. A contact approach is an approach procedure that may be used by a pilot (with prior ATC authorization) instead of a standard or special instrument approach procedure established for the destination airport. A contact approach cannot be requested or authorized for an airport which does not have an instrument approach procedure. As such, the ATC authorization for a contact approach cannot be used by a pilot to proceed to a different airport which does not have an instrument approach procedure. Although ATC provides separation services to a flight during a contact approach, the pilot must assume full responsibility for obstacle clearance and navigation to the destination airport.

C. *Instrument Approaches.* Instrument approach procedures are provided to permit descent in instrument conditions from the en route environment to a point where a safe landing can be made at a specific airport. The types of standard instrument approach procedures include nonprecision and precision approaches based on International Civil Aviation Organization (ICAO) standard Navigation Aid (NAVAID) (ILS, MLS, VOR, VOR/DME, NDB) as well as approaches based on ATC radar services (ASR/PAR). Special instrument approaches procedures have also been developed for approaches requir-

ing the use of special equipment such as area navigation systems, Loran C, airborne radar, or other combinations of navigation systems.

445. CATEGORIES OF INSTRUMENT APPROACH PROCEDURES. Various categories of instrument approach operations have been established to accommodate a wide variety of airborne and ground- or space-based capabilities. These operational categories are necessary for the granting of credit to operators who choose to establish capabilities exceeding the minimum regulatory requirements. These operational categories also provide the distinction between operational capabilities and ground support system configurations. CAT I, CAT II, and CAT III are the three basic categories of instrument approach operations.

A. *CAT I Operations.* CAT I operations are defined as approach and landing operations conducted under IFR using CAT I operating minimums. CAT I operating minimums consist of a specified IFR "altitude or height," minimum descent altitude (MDA) or decision height (DH) that is not lower than the equivalent of 200 feet (60 meters) above the touchdown zone, and a visibility, runway visual value (RVV), or a (RVR) that is not lower than 1/2 statute mile or RVR 1800 respectively. CAT I operations include both precision and nonprecision straight-in approaches and approaches which require a circling maneuver to safely complete a landing on the intended runway. If authorized, circling maneuvers may be used to complete a visual landing on the intended runway following the completion of the instrument portion of either a precision or nonprecision approach. CAT I operations also include visual approaches, CVFP, and contact approaches.

B. *CAT II Operations.* CAT II operations are precision approach and landing operations conducted with a DH of less than 200 feet (60 meters) but not less than 100 feet (30 meters), and a RVR of not less than 1200 feet (350 meters).

C. *CAT III Operations.* CAT III operations are separated into three separate subcategories: CAT IIIa, CAT IIIb, and CAT IIIc.

(1) *CAT IIIa Operations.* CAT IIIa is a precision approach and landing operation with an RVR of not less than 700 feet (200 meters) without a DH, or with a DH of less than 100 feet (30 meters), or an alert height (AH) of 100 feet (30 meters) or less. Both fail-passive and fail-operational airborne equipment can be used in CAT IIIa operations.

(2) *CAT IIIb Operations.* CAT IIIb is a precision approach and landing operation with an RVR of less than 700 feet (200 meters) but not less than 150 feet (50 meters) and a DH of 50 feet (15 meters) or less, or an AH of 100 feet (30 meters) or less. Fail-operational airborne equipment must be used for CAT IIIb operations.

(3) *CAT IIIc Operations.* CAT IIIc is a precision approach and operation landing without a DH and without RVR limitations (zero-zero). CAT IIIc operations are not currently authorized.

447. OPERATING MINIMUMS. The lowest operating minimums for operations conducted under FAR Parts 121 and 135 are specified in standard operations specifications. In general, an air carrier is authorized to use operating minimums specified by the following groups of instrument approach procedures, provided the minimums are not lower than the lowest minimums specified in the air carrier's operations specifications for any particular type of approach procedure.

- A FAR Part 97 instrument approach procedure
- U.S. military instrument approach procedures at U.S. military airports
- Any instrument approach procedures approved and incorporated in the operations specifications
- ICAO contracting state instrument approach procedures at foreign airports
- Instrument approach procedures established by an air carrier at foreign airports provided the procedure is accepted in accordance with the operations specifications

449. CONTROLLING MINIMUM CONCEPT. The concept of a controlling minimum is based on reported weather conditions at the destination airport. The controlling minimum concept includes considerations for the reported weather conditions, the capabilities of the flightcrew, and the capabilities of the airborne and ground- or space-based equipment. This concept prohibits a pilot from continuing past the final approach fix (FAF), or beginning the final approach segment of an instrument approach procedure unless the reported visibility (RVV or RVR, if applicable) is equal to or greater than the authorized visibility (RVV or RVR) minimum for that instrument approach procedure. The basic objective of the controlling minimum concept is to provide reasonable assurance that once the aircraft begins the final approach segment, the pilot will be able to safely complete the landing. The controlling minimum concept, however, permits a pilot to continue a CAT I approach to DH or MDA if the visibility/RVV/RVR was reported to be at or above the controlling minimum when the pilot began the final approach segment even

though a later visibility/RVV/RVR report indicates a below minimum condition. RVR reports, when available for a particular runway, are the reports (controlling reports) that must be used for controlling whether an approach to, and landing on, that runway are authorized or prohibited.

A. *Part 121 CAT I Controlling Minimum.* The CAT I controlling minimum concept for operations conducted under FAR Part 121 is implemented by FAR § 121.651(b). For these operations, the controlling minimum must be used at civilian airports within the U.S. and its territories, and at U.S. military airports, unless the provisions of FAR § 121.651(d) are met. FAR § 121.651(d) permits a pilot to begin the final approach segment even though the reported visibility/RVV/RVR is below the controlling minimum, if the approach procedure is an ILS and the flight is actively monitored by a precision approach radar (PAR). Therefore, pilots are not constrained by the controlling minimum on runways with ILS and active PAR facilities, provided the provisions of FAR § 121.651(d) are met. The controlling minimum concept allows for a pilot to continue a CAT I approach to DH or MDA if the visibility/RVV/RVR was reported to be at or above the controlling minimum when the pilot began the final approach segment even though a later visibility/RVV/RVR report indicates a below minimum condition. Upon reaching DH or MDA and before passing the MAP, the approach may be continued below DH or MDA to touchdown if the requirements of FAR § 121.651(c) are met even though the visibility/RVV/RVR is reported to be below the controlling minimum. The controlling minimum concept does not apply to FAR Part 121 operations conducted at civilian airports in many foreign countries. In foreign countries, FAR Part 121 operators may conduct "look-see" approaches (see paragraph 451) unless the rules of a foreign country (such as the United Kingdom) prohibit look-see approaches. If the rules of the foreign country prohibit look-see approaches, the controlling minimum concept applies in that country.

B. *Part 135 CAT I Controlling Minimum.* The controlling minimum concept for FAR Part 135 differs in application from FAR Part 121. FAR Part 91 applies to all FAR Part 135 operations whether they are conducted in foreign countries or the U.S. (see FAR § 135.3(b). Operations conducted under FAR Part 135 must also be in compliance with FAR § 135.225 (which applies to all operations within the U.S., U.S. territories, U.S. military airports, and foreign airports). For FAR Part 135 operations the controlling minimum concept must be used at all airports. As a consequence, FAR Part 135 operators are prohibited by FAR § 135.225(b) from conducting look-see approaches at any airport (see paragraph 451). The controlling minimum concept, however, allows for a pilot to continue a CAT I approach to DH or MDA if the visibility/RVV/RVR was reported to be at or above the controlling minimum when the pilot began the final approach segment, even though a later visibility/RVV/RVR report indicates a below minimum condition. The controlling minimum concept also allows for a pilot (upon reaching DH or MDA and before passing the MAP) to continue the approach below DH or MDA and touchdown, if the requirements of FAR § 91.175(c) are met, even though the visibility/RVV/RVR is reported to be below the controlling minimum.

451. "LOOK-SEE" APPROACHES. A look-see approach is an authorization to begin an instrument approach and to continue to DH or MDA to have a look-see at the seeing-conditions actually available at those points. Look-see approaches are approaches which can be started and then continued to the three-dimensional point established by the DH or the MDA and the MAP, even when the weather conditions are reported to be below the authorized IFR landing minimums. Upon arrival at the MDA and before passing the MAP, or upon arrival at the DH, the approach may be continued below DH or MDA if the seeing-conditions required by FAR § 121.651(c) or FAR § 91.175(c) are met. A pilot can continue to land using external visual reference if the necessary seeing-conditions are established before passing DH or MDA/MAP. The operational need for look-see approaches is created by wide variations among foreign countries in weather observing, weather reporting practices, and because of limitations associated with manually derived and forwarded weather reports (especially during rapidly changing weather conditions). The weather observation is often taken from a location which is several miles from the landing surface and may not be representative of seeing-conditions encountered at DH, MDA/MAP, or during landing. FAR Part 121 operators may conduct look-see approaches at foreign airports civil and military unless they are specifically prohibited by the foreign country. FAR Part 121 operators, however, are prohibited from conducting look-see approaches at all U.S. airports. FAR Part 135 operators are prohibited from conducting look-see approaches at all airports, both domestic and foreign, by FAR § 135.225.

453. INSTRUMENT APPROACH PROCEDURES.

A. An instrument approach procedure (IAP) is a series of predetermined maneuvers for the orderly and safe transfer of an aircraft under instrument flight

conditions, from the beginning of the initial approach to one of the following:

- An automatic landing
- A position from which a landing can be made visually
- A position from which a missed approach can be executed and completed if external visual references necessary to complete the landing are not established before passing DH or MDA/MAP

B. An instrument approach and its operating minimums are usually prescribed and approved for a specific airport and/or runway by the aviation authority that has jurisdiction over flight operations at that airport. The FAA is responsible for developing all civil IAP's and for specifying the operating minimums for all IAP's in the U.S., its territories, and the U.S. Army IAP's worldwide. In the case of other military IAP's, an instrument approach and its operating minimums are prescribed and approved for a specific airport and/or runway by the authority having jurisdiction over flight operations. There are various types of IAP's that are or may be approved for use by U.S. air carriers. These types of IAP's include the following:

- IAP's published in accordance with FAR Part 97
- IAP's authorized in operations specifications
- FAA-approved special IAP's (FAA Form 8260-7, "Special Instrument Approach Procedure")
- Department of Defense (DOD) IAP's at U.S. military airports
- IAP's published by a foreign country
- IAP's developed by an air carrier in a foreign country in accordance with FAA Order 8260.31, "Foreign Terminal Instrument Procedures"

455. U.S. STANDARD INSTRUMENT APPROACH PROCEDURES (SIAP). SIAP that are approved for all users of the U.S. National Airspace System (NAS) are published in accordance with FAR Part 97 and are incorporated in the operations specifications by reference. Even though CVFP are available for public use by aircraft on IFR flight plans, they are not instrument flight procedures. Except for CVFP's, it may be assumed that any SIAP charted in a National Oceanic Service (NOS) flight information publication is appropriately published in FAR Part 97.

457. OTHER INSTRUMENT APPROACH PROCEDURES (IAP). If an IAP is published in accordance with FAR Part 97 and is based on International Civil Aviation Organization (ICAO) standard NAVAID's, it is available for all users of the U.S. NAS. If, however, an IAP and its operating minimums are not published in accordance with FAR Part 97, other means have been established to authorize their use. In such cases, IAP is incorporated in operations specifications by reference (either with or without additional restrictions). This group of instrument procedures not published in Part 97, includes IAP's developed by certain U.S. military organizations, foreign governments, air carriers, and IAP's based on nonstandard NAVAID's such as TACAN, TALAR, airborne radar, or commercial broadcast stations. Many of these approach procedures are not available to all users due to the special training, knowledge, or equipment required to safely conduct them.

A. *U.S. Military IAP's.* U.S. military IAP's are approved by the local base commander and published by the DOD. Since these procedures comply with U.S. terminal instrument procedures (TERPS) criteria, U.S. military IAP's must be used by air carriers when operating at military airports, unless the procedure is noted "Not For Civil Use" by the military. IAP's published by the DOD for U.S. military airports are incorporated in the operations specifications by reference.

B. *Foreign Government IAP's.* IAP's and their operating minimums at foreign airports are established by the foreign authority having jurisdiction over flight operations at the airport. In general, the IAP's and operating minimums (if specified) at most foreign airports are developed in accordance with U.S. TERPS or ICAO procedures for air navigation services aircraft operations (PANS-OPS) criteria. IAP's developed by foreign authorities using TERPS or PANS-OPS are approved for use by U.S. air carriers in accordance with FAA Order 8260.31 and are incorporated in the operations specifications by reference. In some cases it may be necessary to restrict certain foreign IAP's to make them equivalent to U.S. or ICAO criteria. FAA Order 8260.31 provides direction and guidance for restricting such foreign IAP's. When a restriction to a foreign IAP is required, it must be specified in paragraph C58 of the operations specifications.

C. *IAP's Developed By An Air Carrier.* At some foreign airports, an air carrier may need to develop or choose to develop an IAP. The operations specifications enable an air carrier to exercise this option, provided the developed procedure meets either U.S. TERPS or ICAO PANS-OPS criteria. In such cases, the IAP developed by the air carrier may be authorized

for use by listing it in paragraph C64 of the operations specifications, provided the air carrier submits appropriate supporting information in accordance with FAA Order 8260.31. These procedures may be based on either public or private NAVAID's.

D. *Non-Federal NAVAID's.* Non-federal NAVAID's can be used for public and special IAP's. Approval for the use of these NAVAID's within the NAS is established in FAA Order 6700.14, "Ground Certification of Non-FAA Federally Owned (Non-Military) Navigational Aids," and FAR Part 171. An inspector should become familiar with these documents before issuing approval to use these IAP's. Approval to use these IAP's is accomplished by listing them in paragraph C64 of the operations specifications.

E. *Commercial Broadcast Station IAP's.* In the past, limited authorizations to use commercial broadcast stations have been granted in unique situations. The need for these procedures has been steadily declining because of the increased availability of standard NAVAID's. In general, new approach procedures based on commercial broadcast stations will not be approved. In any case, AFS-400 review and concurrence must be obtained before an inspector may approve an IAP based on commercial broadcast stations.

F. *Special IAP's.* Special IAP's are those procedures developed by the FAA but not published in accordance with FAR Part 97. These special IAP's are not approved for general use due to the special training, procedures, knowledge, and/or equipment required to safely conduct them. Due to these special requirements, the use of special IAP's must be authorized on an operator-by-operator basis. Special IAP's are issued on FAA Form 8260-7 and authorized in paragraph C64 of the operations specifications.

G. *IAP's Outside of Controlled Airspace.* Since ATC separation services are an important element of safe instrument approach operations, special consideration and evaluation is required before operations can be authorized outside of controlled airspace (no ATC separation services available). This situation occurs when conducting an IAP at an airport that does not have an operating control tower or when a control zone is not active. The airports at which portions of IAP's are outside of controlled airspace must be authorized by paragraph C64 of the operations specifications.

459. SPECIAL APPROACH AND LANDING OPERATIONS. U.S. TERPS contain the established minimum criteria for standard IAP's within the U.S. NAS. PANS-OPS, volume II contains the established minimum criteria for IAP's in most foreign countries. These criteria allow for safe instrument approach and landing capabilities for aircraft equipped with ICAO standard NAVAID's (ILS, MLS, VOR, VOR/DME, NDB). Many operators have chosen to use airborne equipment exceeding the minimum capabilities required for instrument flight. A means of granting operational credit for using equipment with these increased capabilities has been established. The operations specifications provide the method to approve approach and landing operations using such airborne equipment. Examples of airborne equipment with increased capabilities include automatic landing systems (autoland), manually flown electronic landing systems (HUD), area navigation systems (RNAV), Loran C systems, and airborne radar approach systems (ARA). The following subparagraphs briefly discuss these systems.

A. *Autoland.*

(1) *General.* Many large transport category airplanes are equipped with autoland systems, and a few helicopters are equipped with automatic deceleration and hover systems. As technology evolves, the trend of using autoland systems is increasing. Autoland systems are already standard features on many new airplanes. An air carrier, however, is not authorized to use autoland systems to touch down in FAR Parts 121 and 135 operations unless the particular flight control guidance system is authorized for autoland by the operations specifications. FAR § 121.579 and FAR § 135.93 prohibit the use of most autopilots below certain heights (50 feet or greater) during approach and landing operations, even during VFR weather conditions. The intent of these rules is to provide pilots with the terrain or obstacle clearance and reaction time necessary to safely intervene if the autopilot malfunctions. This is especially critical if the autopilot abruptly commands a hard-over, nose-down condition. Many autopilots ("single-channel" autopilots) used in FAR Parts 121 and 135 operations are not designed to provide the redundancy necessary to automatically detect all failure combinations. If such failures occur, the pilot must intervene, disconnect the autopilot, and recover manually. Since an aircraft will lose altitude if a hard-over, nose-down condition occurs, the autopilot must be routinely disengaged before descending below the height above terrain specified by FAR § 121.579 or § 135.93, as appropriate. Failure to disconnect the autopilot before descending below these heights could lead to ground contact during a recovery attempt if a malfunction should occur. Many aircraft are now equipped, however, with an automatic flight control guidance system designed to provide the performance, redundancy, and reliability necessary to detect all significant failure

combinations and to prevent the autopilot from failing in a hard-over, nose-down condition (zero height loss). With these aircraft and equipment combinations, the safety objective of FAR § 121.579 and § 135.93 can be met even if the system is used to touchdown. "Fail-passive" and "fail-operational" automatic landing systems provide this capability and can be approved for use to touchdown. The operator's approved training curriculum must include training on autoland operations, and the autoland equipment must be properly certificated and maintained. POI's shall authorize the use of autoland to touch down by issuing paragraph C61 of the operations specifications, "Flight Control Guidance Systems for Automatic Landing Operations Other Than Categories II and III," in accordance with FAA Order 8400.10 and FAR § 121.579(c) or § 135.93(d).

(2) *Use of Autoland to Meet Recency of Experience Requirements for Landings Required by FAR § 121.439.* Paragraph C61 of the operations specifications, dated January 11, 1988, states that the certificate holder is authorized to conduct automatic approach and landing operations (other than CAT II and III) at suitably equipped airports. The certificate holder shall conduct all automatic approach and landing operations in accordance with the provisions of this paragraph. POI's shall observe and adhere to the following direction and guidance involving the granting of landing credit for the use of autoland to meet recency requirements:

(a) *Restriction.* Only one autoland may be used toward satisfying the three landing currency requirements.

(b) *Credit for Autoland.* Credit for one landing each may go to both the pilot-in-command (PIC) and to the second-in-command (SIC).

(c) *Definitions.* For the purposes of this paragraph, the following definitions are applicable:

1. *Autoland Approach:* An autoland approach is a precision instrument approach to touchdown, and in some cases, through the landing rollout. An autoland approach is performed by the aircraft autopilot, which is receiving position information and/or steering commands from onboard navigation equipment. Autoland approaches are flown in VFR and IFR. It is common for operators to require their aircrews to fly coupled approaches and autoland approaches (if certified) when the weather conditions are less than approximately 4,000 feet RVR.

2. *Automatic Landing Systems:* An example of modern airborne equipment, the autoland is often standard on many new airplanes. This modern system gives the aircrew increased capabilities by enabling them to make safer instrument approaches and landings than those being done without the autoland. Autoland also refers to the landing that is accomplished with the autoland when activated during an IFR landing. The aircrew is required to constantly monitor this system to ensure safe operation of the aircraft.

B. *Manually Flown Flight Control Guidance Systems Certificated For Landing Operations.* Historically, pilots have not had flight director systems and other instrument information that enabled safe manual control of an aircraft to touchdown in instrument conditions. The recent development of flight control guidance systems such as HUD provides the pilot with instrument information in a manner that enables safe manual control of the aircraft through touchdown and rollout. The flight guidance provided by these systems enables a pilot to duplicate the performance and functions of an autoland system. Although the provisions of FAR §§ 121.579 and 135.93 do not specifically address use of manually flown flight control guidance systems, the safety objective of these rules is clearly applicable to their use. These systems provide flight guidance information equivalent to the performance, redundancy, reliability, and the hard-over, nose-down protection provided by autoland systems that are approved for use to touchdown. Manually flown flight control guidance systems certified for landing operations can be approved for use to touchdown. The operator's approved training curriculums must include training on such manually flown operations, and the equipment must be properly certificated and maintained. Use of these manually flown systems to touchdown can be authorized by the issuance of paragraph C62 of the operations specifications in accordance with this handbook.

C. *Area Navigation Systems.* IAP's based on RNAV's are not published in FAR Part 97. Within the U.S., these approaches are special IAP's developed for special use and issued on FAA Form 8260-7. An RNAV IAP may be developed and used by an air carrier, provided supporting information is submitted to the FAA. Since criteria for RNAV IAP's have not been established in ICAO PANS-OPS, all foreign RNAV IAP's must be developed in accordance with U.S. criteria. The use of RNAV systems to conduct IAP's can be authorized by issuing paragraph C63 of the operations specifications. RNAV IAP's are special IAP's; therefore, each RNAV IAP approved for a particular air carrier must be listed in paragraph C64 of the operations specifications.

D. *Airborne Radar Approaches.* ARA's are based on the use of airborne radar. Within the U.S,

ARA's are classified as special IAP's and are established by the issuance of FAA Form 8260-7. Use of ARA's can be authorized through operations specifications, if the criteria in Advisory Circular (AC) 90-80, "Approval of Airborne Radar Approach (ARA) Procedures for Helicopters to Offshore Platforms," as amended, and this handbook are met.

E. *Offshore Approach Procedures (OSAP).* OSAP's are based on the use of Loran C and the airborne radar systems. OSAP's are established and approved in accordance with the criteria in AC 90-80. The use of OSAP's can be authorized by operations specifications.

461. GLOBAL POSITIONING SYSTEM (GPS) APPROACH PROCEDURES. The FAA has authorized GPS overlay approaches in order to accelerate the availability of nonprecision instrument approach procedures that can be flown using IFR certified GPS equipment. The overlay approaches allow pilots to use GPS equipment to fly existing VOR, VOR/DME, NDB, NDB/DME, and RNAV nonprecision instrument approach procedures. The purpose is to permit pilots to transition from ground-based to satellite-based navigation technology for instrument approaches.

A. *Compliance with FAR §§ 121.349 and 135.165.* Air operators may be authorized to use single GPS navigation equipment as a primary navigation system for IAP's if the airplane is equipped with two VOR receivers, or two automatic direction finder (ADF), as appropriate, receivers and ground NAVAID'S are positioned such that the flight can, following the failure of the GPS system, continue safely to a suitable alternate airport and complete an approach using the remaining airborne equipment. Additional requirements may be mandated for airports requiring special qualification in accordance with FAR § 121.445 as provided in volume 3.

B. *Alternate Airport Requirements.* Required alternate airports must have an approved instrument approach procedure, other than GPS or LORAN C, which is anticipated to be operational at the estimated arrival time.

463. GPS OVERLAY APPROACH PROCEDURES. The data that supports en route and terminal operations and a navigation database that supports GPS overlay nonprecision instrument approaches (except localizer, LDA, and SDF) contain the coordinates for the waypoints, fixes, and NAVAID's published in FAR PART 97, Standard Instrument Approach Procedures. Special instrument approach procedure data may be included at the request of those operators authorized to use the procedures. Data for approach procedures into military airports also may be included if the procedures are available, and authorized for civil operations. In addition, all waypoints to support GPS stand alone approaches are also contained in the database. Air operators must be specifically authorized to conduct instrument approach operations using GPS. To authorize GPS approaches, operations specifications paragraph B31 will require amendment.

A. *GPS Overlay.* GPS overlay approaches are limited to U.S. NAS. Whether or not an approach is included in the database depends on its codability and flyability using GPS equipment. Therefore, FAR Part 97, military, and special approaches are classified into codable and non-codable nonprecision instrument approaches.

NOTE: An aircraft is not authorized to fly any IFR approach using GPS unless that instrument approach procedure is retrievable from the navigation database.

(1) *Codable Approach Procedures.* All approved GPS navigation databases contain the latitude and longitude coordinates for waypoints, fixes, and NAVAID's for those FAR Part 97 civil use, and military, nonprecision approaches considered codable for database purposes and considered safe to fly by the FAA using normal piloting techniques. Special approaches may be included at authorized user request.

(2) *Non-Codable Approach Procedures.* Certain Far Part 97 nonprecision instrument approaches as well as some military and special procedures may present an unresolvable coding situation relating to database or equipment interface constraints. An approach may be determined to be not codable or not flyable by the FAA, by the database coding agency, or by the manufacturer of the navigation equipment. In addition, some procedures may, in the opinion of the FAA, present a potential safety hazard to normal piloting techniques using GPS equipment. These procedures will not be included in navigation databases. Approach procedures that are omitted from the database can not be legally flown using GPS navigation equipment.

(3) *Waypoints.* As a minimum, the GPS overlay approaches require that the databases contain waypoints representing the IAF, FAF, MAP, and the missed approach holding point for each VOR, VOR/DME, NDB, NDB/DME, TACAN, and RNAV nonprecision instrument approach procedure. Intermediate Fixes (IF) and all named fixes are also included. All waypoints are displayed in the same sequence as they are presented on the published nonprecision instrument approach procedure charts.

NOTE: User modification or entry of data associated with published instrument approach procedures is not possible, and not authorized.

(a) Waypoint data utilized in nonprecision instrument approach procedures is stored by name or identifier, and latitude and longitude. The waypoints are not designated in terms of bearing (or radial) and distance to/from a reference location.

(b) Waypoints that define the MAP and Missed Approach Holding Point (MAHWP) are always coded as "fly over". This type of waypoint requires the aircraft to pass directly over it.

(c) When turn anticipation is expected at an IAF or other waypoint the waypoint is coded as "fly by".

(4) *Waypoint Names Coded in the Navigation Database.* Flying an FAR Part 97 or military nonprecision instrument approach procedure using GPS equipment should be transparent to air traffic control. Therefore, the same track is flown whether using GPS equipment or standard ICAO NAVAID's. Waypoints coded in the navigation database reflect exactly those names appearing on the instrument approach procedure. For example, if an IAF or other fix is assigned a pronounceable five-letter alpha character name, it will be the same name coded in the database, the name which will appear on the avionics display, the name appearing on a chart, and the name verbally used by ATC. If no five character name is published for the approach waypoint fix, it will normally be coded with a database identifier. A pilot must associate the coded name appearing on the display with the position shown on the chart. However, these coded names may not be known or used by ATC.

(a) *Initial Approach Waypoint.* If the IAF is a named waypoint or fix, then the same name is used for the IAF waypoint in the database. If the IAF is a NAVAID, the IAF waypoint is coded with the NAVAID identifier.

(i) A database identifier is provided for an unnamed IAF.

(ii) When an IAF is the beginning of a DME arc segment, the IAF is often unnamed, but is marked by a radial intersecting the arc. In these cases, the unnamed IAF waypoint is coded in the database to represent the beginning of the DME arc.

(b) *Turning points in the Initial Segment.* An initial segment may incorporate a named or unnamed turn point to intercept a course.

(i) In some cases, a waypoint may be established at turn point where a dead reckoning heading intersects the course. This waypoint is coded into the waypoint sequence for GPS navigation, but may not be named on the chart.

(ii) A turn point may be defined by the intersection of two NAVAID radials or bearings. In this case, a waypoint name appears in the sequence.

(c) *Intermediate Waypoint.* If the IF is a named waypoint or fix, then the same name is used for the IF waypoint in the database. If the IF ia a NAVAID, the IF waypoint is coded with the NAVAID identifier. An unnamed IF is assigned a database identifier.

(d) *Final Approach Waypoint.* Procedures With a Final Approach Fix (FAF). If the FAF is a named waypoint or fix, the same name is used for the FAF waypoint in the database sequence. An unnamed FAF, such as a DME fix, is coded with a descriptive FAF waypoint related to the NAVAID providing final approach course guidance. It also appears in the waypoint sequence.

(i) *Procedures Without a FAF.* Procedures without a FAF and without a stepdown fix have a Sensor FAF waypoint coded in the database at least 4 NM to the MAP waypoint. (The MAP, in this case, is always located at the NAVAID facility.) A Sensor FAF is a final approach waypoint created and added to the database sequence of waypoints to support GPS navigation of an FAA published, non-FAF, nonprecision instrument approach procedure. The coded name or Sensor FAF appears in the waypoint sequence. If a stepdown fix exists on the published procedure and it is greater than 2 NM to the MAP, the stepdown fix is coded in the database as the Sensor FAF waypoint for the waypoint sequence. If a stepdown fix distance is 2 NM or less to the MAP, a Sensor FAF waypoint is coded at least 4 NM to the MAP.

(e) *Missed Approach Waypoint.* When a missed approach point is located at the NAVAID, the MAP waypoint is coded in the sequence at the NAVAID position using the NAVAID identifier. When the missed approach is initiated near the runway threshold (timed approach) or at a specified DME distance from a NAVAID, a MAP waypoint is created and coded in the database.

(f) *Missed Approach Holding Points.* Missed approach holding points are normally at a NAVAID or named fix. Therefore, the NAVAID identifier or the fix name is coded in the database as the missed approach holding waypoint and appears in the waypoint sequence.

(g) *Waypoints and Fixes not Coded for GPS Overlay Approaches.* A Visual Descent Point (VDP)

is a fix appearing on some published nonprecision approach procedures that is not included in the sequence of waypoints. Pilots are expected to use normal piloting techniques for beginning the visual descent. In addition, unnamed stepdown fixes in the final approach segment will not be coded in the waypoint sequence unless the stepdown fix is used as a Sensor FAF on a non-FAF procedure.

(5) *Approach Selection Process.* Pilots must retrieve instrument approach procedures from the database through a menu selection process. No manual waypoint loading is permitted, although some pilot action is required during certain segments of the approach (see figure 4.2.2.1.).

NOTE: This process may vary from one avionics manufacturer to another; therefore, pilots must be thoroughly familiar with the FAA-Approved Flight Manual or Flight Manual supplement.

(6) *Waypoint Sequence.* The sequence of waypoints in the database and those displayed by the equipment will consist of, as a minimum, waypoints representing the selected IAF and its associated IF's (when applicable), FAF, MAP, and the MAHWP.

(7) *Relationship of Avionics Displayed Waypoints to Charted Data.* GPS overlay approach waypoints contained in the database represent the waypoints, fixes, NAVAID's, and other points portrayed on a published approach procedure beginning at the initial approach fix. Certain unnamed points and fixes appearing on a chart are assigned a database identifier. There is no requirement to furnish charts with these database identifiers; however, charting agencies may incorporate them at their discretion.

NOTE: Database identifiers should not be used for pilot/controller communications and flight planning.

(8) *Differences Between Displayed and Charted Navigation Information.* There may be slight differences between the navigation information portrayed on the chart and the GPS navigation display. Course differences will occur due to an equipment manufacturer's application of magnetic variation. Distance differences will occur due to the mismatch between GPS ATD values and the DME values published on underlying procedures.

B. *The GPS Stand Alone Approach.* A sequence of waypoints defining the point to point track to be flown will be coded in the database including the initial approach waypoint, intermediate waypoint, final approach waypoint, missed approach waypoint, missed approach turning waypoint and missed approach holding waypoint. All waypoints, except a missed approach waypoint at the runway threshold, will be named with a five-letter alpha character name. Missed approach waypoints at the threshold will be assigned a database identifier. The sequence of waypoints appearing in the display should be identical to the waypoint sequence appearing on an associated approach chart.

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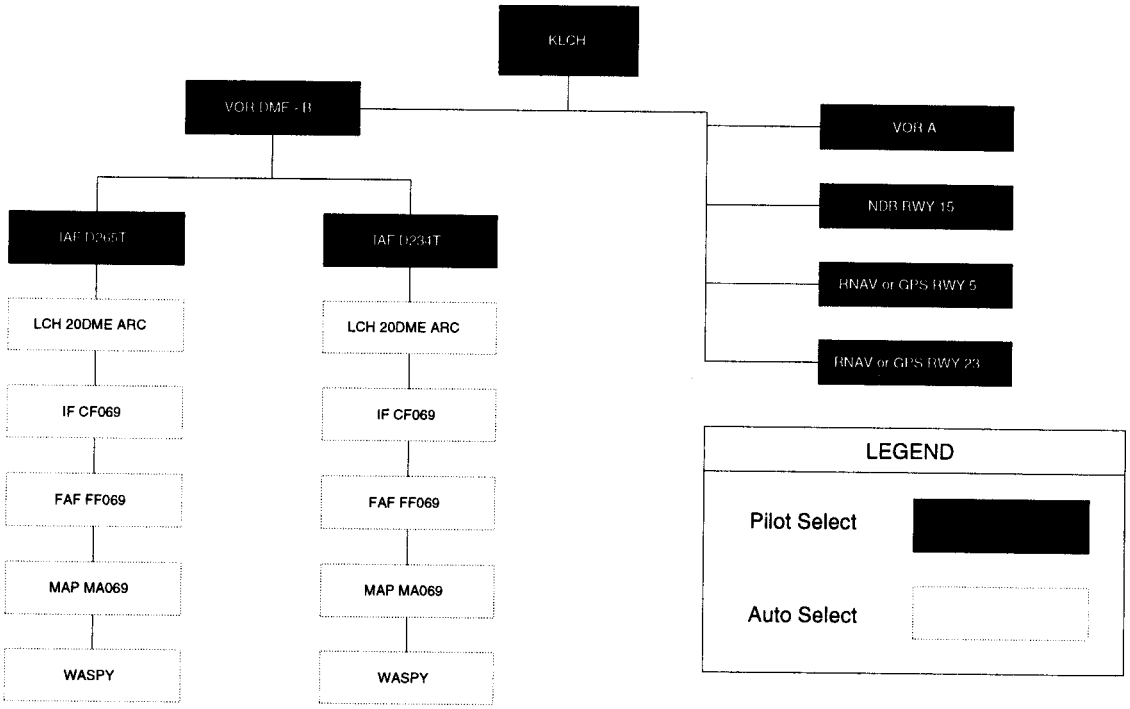
FIGURE 4.2.2.1
SAMPLE APPROACH SELECTION PROCESS



After selecting the airport and approach information as outlined in the FAA-approved Flight Manual or Flight Manual Supplement, the waypoints will be automatically presented in the proper order to fly the approach. Pilots must arm (enable) approach mode prior to the IAF.

This approach can be initiated from one of two IAF waypoints. These IAF waypoints are along the 20nm arc at points defined by the 234 and 265 degree radials from LCH. The IAF at R-234 will likely appear in the database as D234T. D234T represents a point located on the 234 degree radial of the Lake Charles VORTAC at 20nm, The letter T is the twentieth letter of the alphabet and is used to indicate a distance of 20nm. In addition, a waypoint is coded in the database at the intersection of the arc and final approach course CF069. The approach waypoint sequence in this case is D234T (IAF), CF069, FF069 (FAF), MA069 (MAP), and WASPY. The same sequence is provided for the other arc, except the it starts at D265T. The display in the receiver and procedure for flying the arc may vary with the manufacturer. Pilots should consult the FAA-approved Flight Manual or Flight Manual Supplement for further details.

From either IAF, normal piloting techniques are used to maintain the ground track of the arc route to the waypoint located at the intersection of the final arc and the final approach course (CF069). From here the GPS equipment will sequence to the FAF (FF069). At 2nm from the FAF, the display sensitivity begins transitioning to where full scale deflection is .3nm either side of the centerline.

At the FAF, the waypoint automatically sequences to the MAP (MA069). An along track distance is provided to the MAP waypoint. Since the step-down fix (d8.0) is not an FAA named fix, it is not included in the waypoint presentation, however, the point can be identified by an along track distance to MA069. When the ATD is 1.6nm to the map, the fix is identified. Note that on this approach there is a difference between the DME distance depicted in the profile view and the along track distance. In such cases, the along track distance at the bottom of the profile view can be used to monitor the GPS distance readout.

At the MAP waypoint the receiver automatically changes to manual operation and the pilot must sequence the receiver to the next active waypoint. Once complete, the missed approach waypoint (WASPY) is displayed as the next waypoint. The first part of the missed approach procedure is flown. Climb to 1,700 feet, then climbing right to 2,000 feet outbound via LCH VOR R249 to WASPY. Normal piloting techniques are to intercept a 249 degree course (a TO-TO bearing of 249 degrees) to WASPY. Display sensitivity begins to change to a full scale deflection of 1nm either side of centerline once WASPY is sequenced.